Space Weather Technical Forecast

Issued on Friday, 05 July 2024 at 01:14 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of M-class flares throughout.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Moderate with two M-class flares in the past 24 hours, an M1.0 flare at 04/1425 UTC and an M1.4 flare at 04/2005UTC, both from AR3730 which is no longer visible due to its proximity to the western limb.

There are nine sunspot regions on the disc, and perhaps signs of an arriving tenth over the southwestern limb in EUV. The main changes in the period have been marked penumbral areal growth in AR3733 in the northwest, with a tenuous delta spot now visible in the trailing group. Also of note was AR3729 which showed some consolidation as a relatively open F-group. Two new groups have appeared on the disc as relatively small and simple beta groups, AR3737 near the western limb and an unnumbered region just west of centre disc. All other groups were apparently stable or weakening.

No Earth-directed Coronal Mass Ejections (CMEs) have been observed in imagery during the past 24 hours.

Solar Wind / Geomagnetic Activity: Solar winds as observed by ACE at L1 were at Background levels with a peak of 392 km/s at 03/0023UTC. The solar wind density rose through single figures ppcc, finishing at above average levels around 14ppcc. The IMF was largely was weak to moderate, with a peak of 10nT around 04/1900UTC, with the north-south component +9 to -9nT. The phi angle was mainly positive (away from the Sun).

The net result of the above solar wind measures was for Quiet to Unsettled (Kp 0-3) geomagnetic indices

Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux observed by GOES18 remained at Background levels.

High energy electron flux (greater than 2MeV) observed by GOES16 was initially at moderate levels, but slowly decayed back to background through the period with a peak of 715pfu at 04/2310UTC. The 24-hour fluence remained below Active on a declining trend, with 9.6e6 integrated pfu observed at 05/0001UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: There is a flat daily Chance of further isolated M-class flares, perhaps most likely from AR3733. Upcoming sunspot region arrivals over the eastern solar horizon in the period should help compensate for western limb losses.

Solar Wind / Geomagnetic Activity: No CMEs feature in the forecast.

Geomagnetic activity is expected to persist as Quiet to Unsettled (Kp0-3) through the next four days, with the greatest chance of departure from this being over the UTC weekend, with a Slight Chance of isolated Active (Kp4) intervals.

Energetic Particles / Solar Radiation: High energy proton flux is expected to remain at

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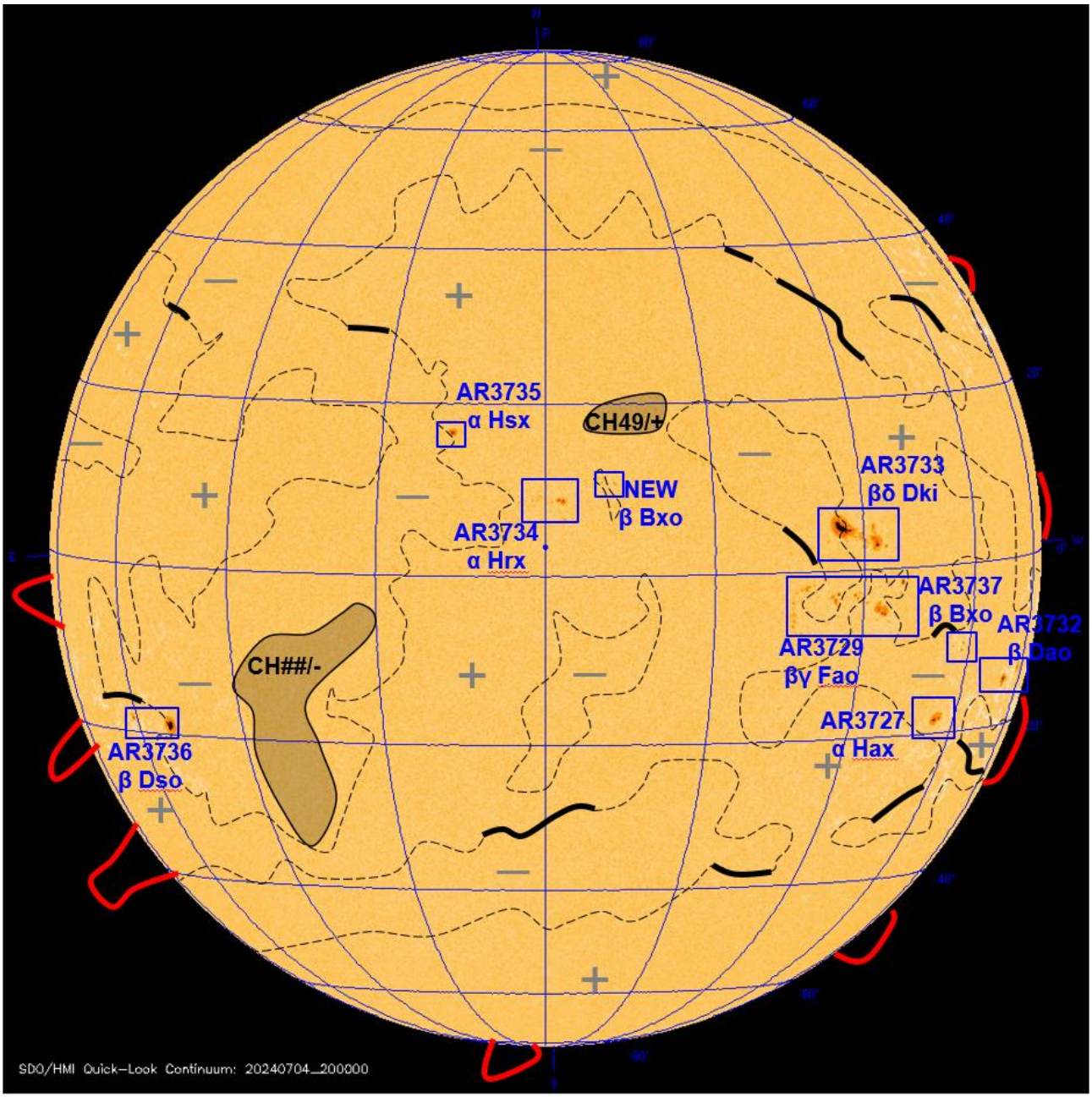
Background levels.

High energy electron flux is most likely to peak at Moderate levels over the coming days, with a gradual decreasing trend. With only a Slight Chance of reaching Active electron fluence.

Figure 1. Solar Analysis Valid 04/2000UTC.



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Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

No Earth-directed CMEs feature in the forecast.

In the likely absence of any CME arrival, the solar wind may now follow a slow regime throughout the four-day period. The main uncertainty in this regard is a returning but now very tenuous coronal hole (49/+ near centre-disc). This has apparently further closed in EUV (e.g. AIA211) in the past 24-hour period, being increasingly eclipsed by bright flux to its east. Even with this trend, the emanating and potentially Earth-affecting solar wind from CH49/+ will have departed prior to this occurring and this is the basis for maintaining a small chance of slightly elevated or perhaps elevated wind speeds either late day 2 or early day 3 (06 or 07 July).

Geomagnetic activity is expected to persist as Quiet to Unsettled (Kp0-3) through the next four days, with the greatest chance of departure from this being over the UTC weekend, with a Slight Chance of isolated Active (Kp4) intervals.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	1	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Nil.

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Radio Blackouts - X-Ray Flares:

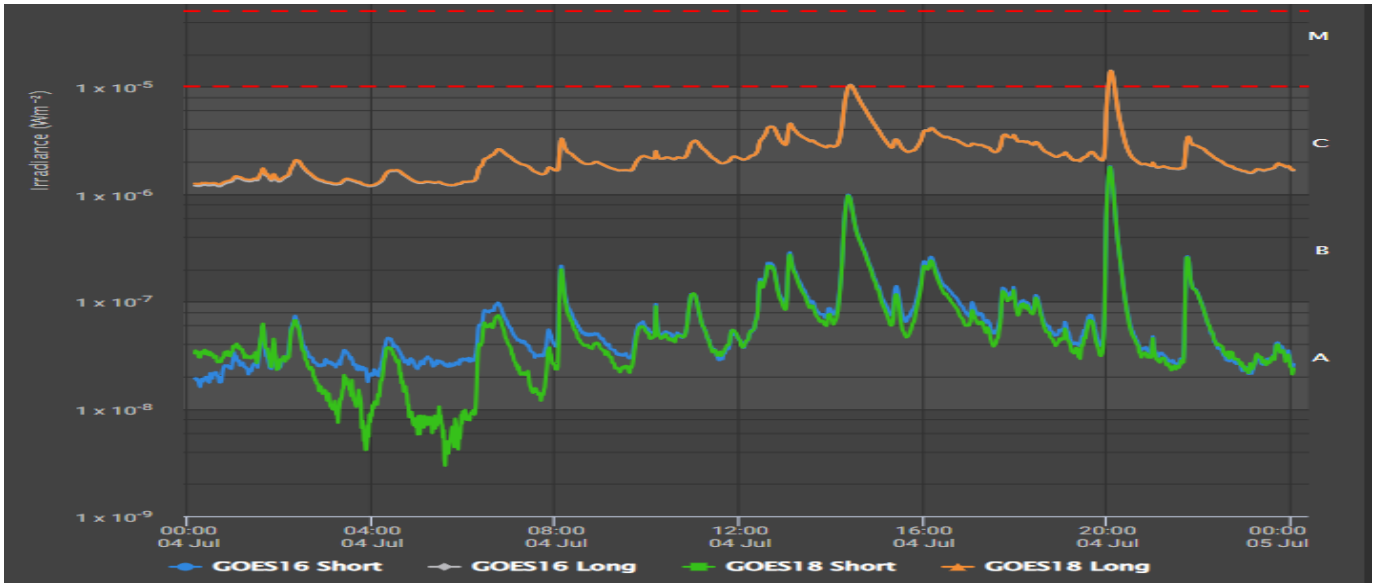
There are nine sunspot regions on the disc. The main changes in the period have been marked penumbral areal growth in AR3733 in the northwest, with a tenuous delta spot now visible in the trailing group. Also of note was AR3729 which showed some consolidation as a relatively open F-group. Two new groups have appeared on the disc as relatively small and simple beta groups, AR3737 near the western limb and an unnumbered region just west of centre disc. All other groups were apparently stable or weakening.

The recent growth in AR3733 is the main rationale for maintaining the daily 30% Chance of M-class activity, despite the fact that the two M-flares sense in the past 24 hours have originated from AR3730 which is no longer visible due to its proximity to the western limb.

The eastern solar horizon now appears to be harbouring a returning region in the southern solar hemisphere, with flux looping visible here on AIA094 and 171 - this is perhaps most likely to be Ex-AR3711. A few further returning regions may also manifest later in the UTC weekend as the western facing side gradually depopulates, leading to an overall relatively flat Chance of M-class flares in the period.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	30	30	30	30
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 2: Latest GOES 16/18 X-ray trace



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Solar Radiation Storms - (High Energy Protons):

There has been little recent response in GOES18 high energy proton flux measurements to low-level M-class flares of late. However many of the more complex sunspot regions on the disc are now nearing the better-connecting western portion of the disc, leading to a Slight Chance of S1 or greater as these groups round the limb.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

High Energy Electrons Event (≥ 2MeV):

The new calendar month has seen a day-on-day rise in high energy electron flux recorded at GOES16, although the current diurnal trend appears to show that this has saturated at mainly Moderate to background levels.

With the strong possibility of no further drivers for increasing electron populations in the period, the most probable evolution is for a very slow erosion of the current GOES16 trace in the slow solar wind environment. The main question mark as to this continuing is the possible presence of CH49/+ over the UTC weekend, with uncertainty increasing as levels perhaps take a temporary dip at GEO, with a uncertain but probably muted recovery in fluence into the new UTC working week. MOSWOC REFM is considered good guidance for a slight reduction in fluence over the coming days.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	5	1	1	5
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 3: MOSWOC REFM showing a below Active forecast

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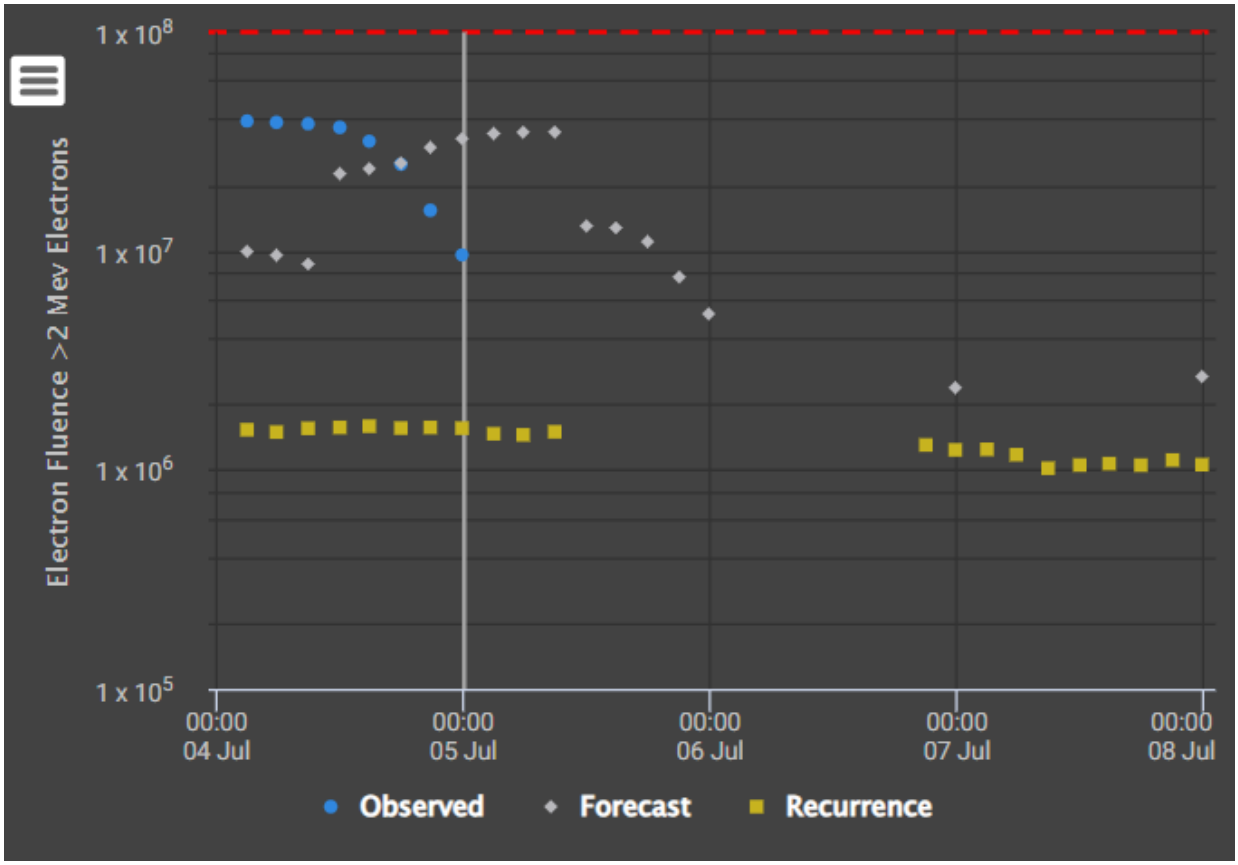

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